

SCRAMBLED CODE LETTERS FOR PROGRESS REPORT 73
PROJECT 1103-17

Company - Mill	Machine No.	Code Letter
The Chesapeake Corporation - West Point	1	--
Continental Can Company, Inc. - Hepewell	1	J
- Hedgo	4	D
Crown Zellerbach Corporation - Baltimore	1	--
- Baltimore	2	--
- Bogalusa	4	O
- Lebanon	2	E
International Paper Company - Bastrop	1	I
- Bastrop	2	--
- Cooragetown	1	B
- Cooragetown	2	--
The Mead Corporation - Harrison	1	G
- Knoxville	1	H
- Lynchburg	2	C
- Sylva	1	M
St. Regis Container Corporation Mill Division - Cosheston	1	P
North Carolina Pulp Company - Plymouth	3	K
Olin Mathieson Chemical Corporation - Monroe	1	--
- Monroe	2	--
Owens-Illinois Glass Company - Tomahawk	1	R
- Tomahawk	2	L
- Tomahawk	3	A
- Big Island	1	--
- Big Island	2	--
- Big Island	3	F
St. Joe Paper Company - Port St. Joe	1	N
Union Bag-Camp Paper Corporation - Savannah	2	G
West Virginia Pulp and Paper Company - Covington	6	--
- Covington	7	--
- Charleston	--	--

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

CONTINUOUS EVALUATION OF CORRUGATING MEDIUM

Project 1108-17

Progress Report 77

to

FOURDRINIER KRAFT BOARD INSTITUTE, INC.

November 1, 1960

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THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

SUMMARY

The purpose of this study is to provide a continuous evaluation of the quality and runability of the corrugating mediums manufactured by members of the Fourdrinier Kraft Board Institute. The program is implemented in the following way: Two rolls of corrugating medium are submitted on a weekly basis from the production of each machine. Each roll is evaluated for basis weight, caliper, Concora flat crush (conditioned after fluting), and runability, the latter being measured by corrugating each roll under standardized conditions into A-flute board at 600 feet per minute with minimum tension. If runability is unsatisfactory at this speed, the speed of the corrugator is reduced by increments of 25 f.p.m. until satisfactory runability is obtained as indicated by the absence of ruptured flutes. If the runability is satisfactory at 600 f.p.m. with minimum tension, the tension is increased by increments of 1/2 lb. per in. to determine the maximum tension at which satisfactory runability is obtained. The maximum tension used is 1-1/2 lb. per in. Flat crush tests are made on the single-faced board obtained at the maximum speed with minimum tension.

In addition to the evaluation carried out at the Institute as described above, each participant may, if he so desires, evaluate each roll of corrugating medium for Concora flat crush (conditioned after fluting) and submit the results to The Institute of Paper Chemistry, thus providing an opportunity to include a comparison of Institute and mill Concora flat crush results in the monthly progress reports.

The study, as described in the preceding paragraphs, provides several important benefits. For example, it enables each participant to evaluate his quality position in relation to the rest of the industry on a continuing basis. In addition, it provides a basis for comparing Concora flat crush results obtained at the Institute with those obtained at the mills on corresponding rolls of medium. This type of comparison is a helpful adjunct to conventional calibration procedures. Another benefit is provided by virtue of the fact that the study is accumulating an evergrowing reserve of background information essential for the judicious interpretation of any proposed specifications on corrugating medium whether on a company or industry basis.

During the month of October, 87 rolls of corrugating medium were submitted to The Institute of Paper Chemistry from the production of eighteen machines.

Shown below are the maximum and minimum current machine averages noted for each test during October (the current machine average is the average of the results obtained on all rolls submitted from a given machine during the current period); also given for each test is the current F.K.I. average which is determined by averaging the current machine averages and is indicative of the test level being maintained by the industry as a whole to the extent that the industry is represented by the participating machines:

	Maximum Current Machine Average	Minimum Current Machine Average	Current F.K.I. Average
Basis weight, lb.	28.9	25.9	27.3
Caliper, pt.	11.8	9.0	10.4
Concora flat crush, p.s.i. (Conditioned after fluting)	41.0	31.0	36.3
Single-face flat crush, p.s.i.	37.0	27.8	33.2

The runability data for the 87 rolls of medium evaluated during October are summarized as follows:

Runability	Number of Rolls	Percentage of Total Rolls
Less than 600 f.p.m. with minimum tension	0	0.0
600 f.p.m. with minimum tension	7	8.0
600 f.p.m. with tension of 1/2 lb. per in.	14	16.1
600 f.p.m. with tension of 1 lb. per in.	22	25.3
600 f.p.m. with tension of 1-1/2 lb. per in.	44	50.6

Concora flat crush results obtained on specimens conditioned after fluting were submitted for fourteen of the eighteen machines from which rolls were received during the current month. The comparisons of Concora flat crush test results based on the average result obtained at the Institute and at the mill for all rolls compared for each machine are summarized below. Shown in this summary is the number of machines (and the percentage of the total machines which they represent) whose Concora test averages fall within the indicated percentage ranges from the results obtained at the Institute on the same rolls.

Average Percentage Difference Between Institute and Mill Concora Flat Crush Test Results ^a	Number of Machines	Percentage of All Machines
± 1.0	5	35.7
± 2.5	7	50.0
± 5.0	11	78.6
± 8.7	14	100.0

^a The average obtained at the Institute was used as the reference in the calculation of the percentage differences.

CONTINUOUS EVALUATION OF CORRUGATING MEDIUM

PURPOSE OF THIS STUDY

The purpose of this study is to provide a continuous evaluation of the quality and runability of corrugating medium produced by members of the Fourdrinier Kraft Board Institute. The study, as it progresses, is accumulating a backlog of data and experience which provides several important benefits. For example, it enables each participant to evaluate his position in relation to the rest of the industry. In addition, it provides background information essential for the judicious interpretation of any proposed specifications on corrugating medium (on either a company or industry basis). The program also provides a basis for comparing Concora results obtained at the Institute with those obtained at the mills on corresponding rolls of medium. This comparison is a helpful adjunct to conventional calibration procedures.

PROCEDURE FOR PARTICIPATING

The procedure for participating in this study involves the submission of two rolls of corrugating medium per week from each machine to The Institute of Paper Chemistry. These rolls are taken from regular production runs on different days. Each roll is 10 to 12 inches wide and contains approximately 5,000 lineal feet of medium (approximately 30 inches in diameter). When received by the Institute, each roll is assigned a code letter and number. The rolls are numbered in the sequence in which they are received. Code letters are assigned on the basis of machines, and a given machine is assigned a

different code letter each month in order to mask the identity of the mills. For purposes of reference, an outline of this program which describes the necessary instructions for sampling was appended to Progress Report One in this series.

PRESENTATION AND DISCUSSION OF TEST RESULTS OBTAINED AT
THE INSTITUTE OF PAPER CHEMISTRY

During the month of October, eighty-seven rolls of corrugating medium were selected from the production of eighteen machines and submitted to The Institute of Paper Chemistry for evaluation. A tabulation of the number of rolls submitted from each machine is given in Table I.

Each sample of corrugating medium was evaluated for basis weight, caliper, Concora flat crush (conditioned after fluting), H. and D. flat crush (single-faced board), and runability. (Concora flat crush results obtained on specimens tested immediately after fluting were included in Progress Reports 45 through 57). Runability was measured by corrugating each roll under standardized conditions on the Institute's corrugator into A-flute board at 600 feet per minute with minimum tension. If unsatisfactory runability occurred at this speed, the corrugator was slowed down in increments of 25 f.p.m. until satisfactory runability was obtained (no ruptured flutes). If the medium fabricated satisfactory at 600 f.p.m. with minimum tension, further runs were made at higher tensions to determine when cracking occurred. The higher tensions used were 0.5 lb. per inch, 1.0 lb. per inch, and 1.5 lb. per inch.

TABLE I
NUMBER OF ROLLS OF CORRUGATING MEDIUM SUBMITTED
FOR EVALUATION FROM EACH MACHINE

Machine Code	Number of Rolls
A	6
B	2
C	4
D	2
E	4
F	5
G	8
H	6
I	5
J	5
K	5
L	8
M	4
N	4
O	6
P	2
Q	6
R	<u>5</u>
Total	87

Flat crush was determined on the board obtained at a speed of 600 f.p.m. with minimum tension. In addition to information about quality, these results will provide data which may be useful in studying the relationship between Concora flat crush and combined board flat crush for each participant's medium.

As requested by members of the F.K.B.I., the Concora medium test results are calculated on the basis of pounds of load per unit area rather than on the basis of the formula suggested by the Concora manufacturer and are reported as Concora flat crush test results. In Progress Reports One and Two, the Concora medium test results were reported on the basis of the formula suggested by the Concora manufacturer.

The average test results obtained on the rolls of corrugating medium submitted by each participant (current machine averages) are shown in Table II and graphically presented in Figures 1 to 4. In addition to a comparison of the test data obtained for the various machines, Table II also presents the current F.K.I. averages, cumulative F.K.I. averages, and the F.K.I. indexes. The current F.K.I. average is the average of test results for all machines participating in the study during the current month. The cumulative F.K.I. average is based on the results for the previous twelve-month period excluding the result for the current period. The F.K.I. index is obtained as follows:

$$\frac{\text{current F.K.I. average}}{\text{cumulative F.K.I. average}} \times 100 = \text{F.K.I. index (\%)}$$

The F.K.I. index provides a ready means of comparing the current quality with previous results. An index greater than 100% indicates that current quality is higher than the average result for the previous twelve periods; an index

TABLE II
SUMMARY OF CURRENT MACHINE AVERAGES
October, 1960

Code	Basis Weight, lb.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.
A	27.6	10.2	37.1	34.6
B	27.0	10.5	37.6	34.7
C	27.4	9.2	33.3	30.7
D	25.9	9.6	38.7	36.1
E	26.3	10.5	31.0	27.8
F	26.4	10.3	34.0	32.1
G	27.6	9.8	37.1	33.6
H	27.4	11.8	36.5	31.9
I	26.7	10.7	38.6	34.4
J	28.9	11.2	41.0	37.0
K	27.2	10.3	37.4	36.9
L	27.2	10.3	38.5	34.9
M	27.7	11.0	35.2	31.4
N	28.4	9.0	38.0	34.6
O	27.3	11.1	33.4	30.8
P	28.1	10.3	34.6	29.6
Q	27.0	10.5	34.0	31.0
R	26.8	10.1	36.6	34.6
Current F.K.I. Average	27.3	10.4	36.3	33.2
Cumulative F.K.I. Average	27.4	10.3	36.3	32.9
F.K.I. Index, %	99.6	101.0	100.0	100.8

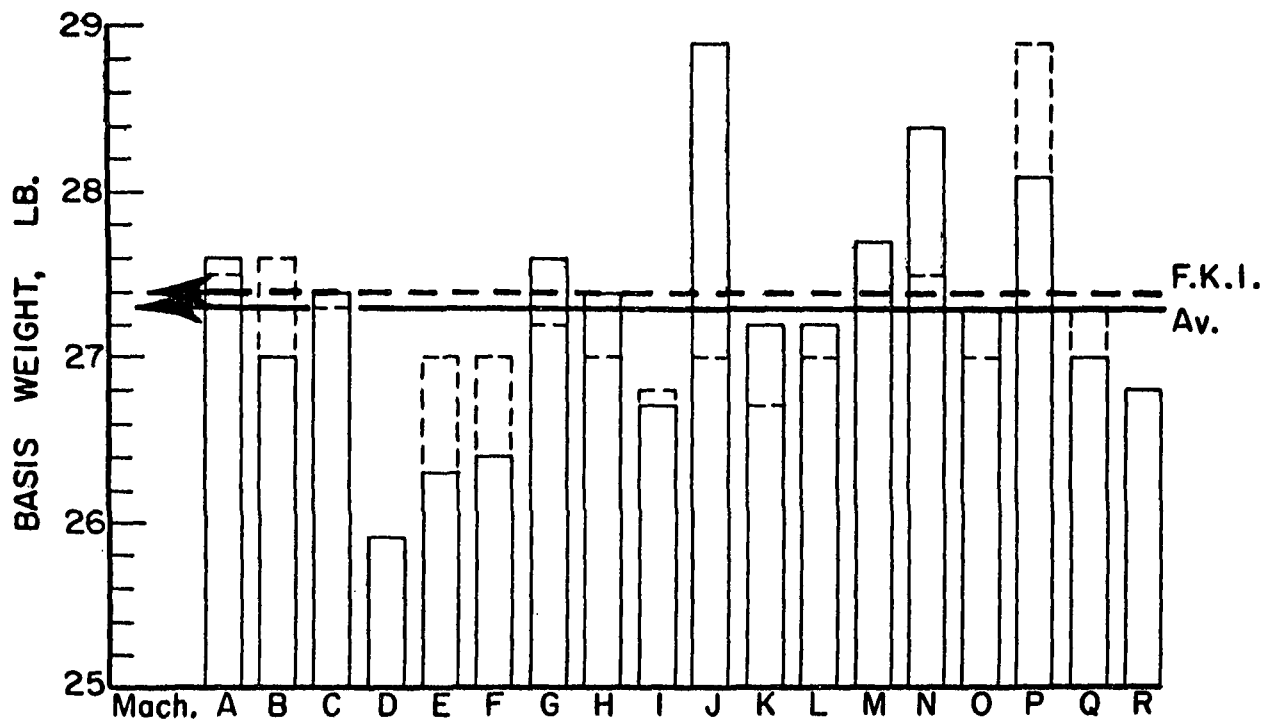


Figure 1. Comparison of Basis Weight Results for October, 1960

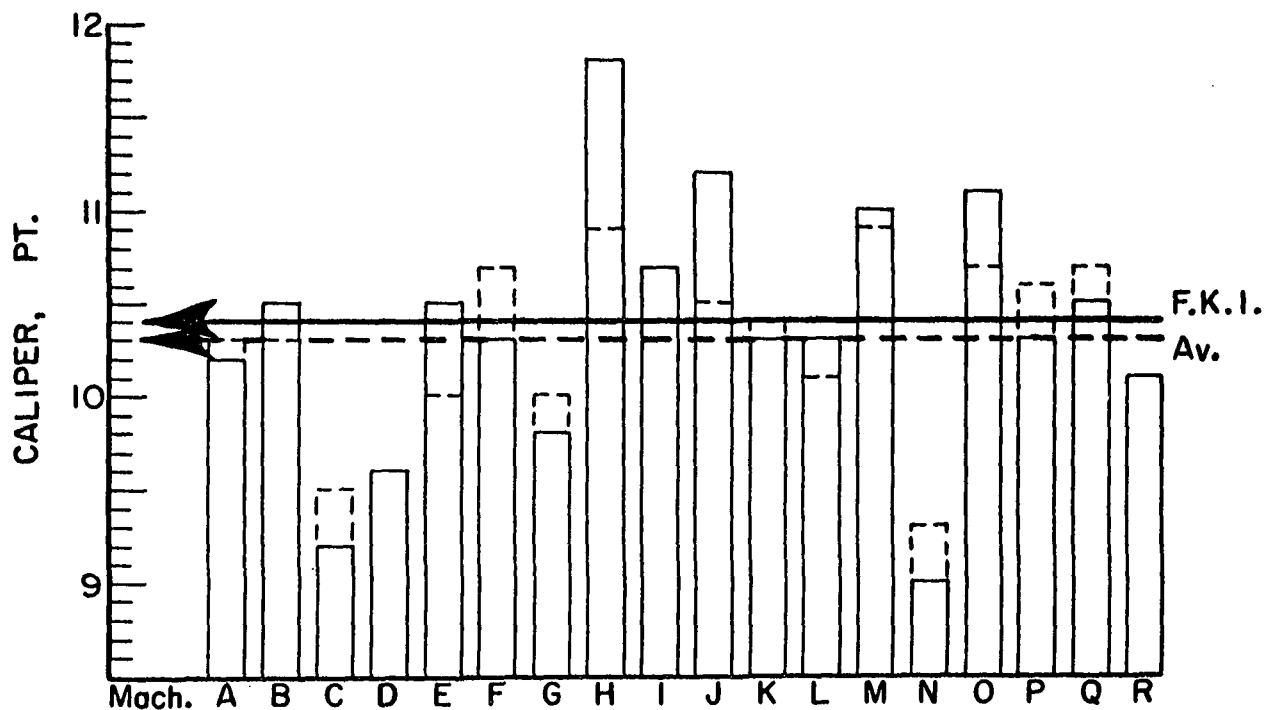


Figure 2. Comparison of Caliper Results for October, 1960

———— Current machine average
----- Cumulative machine average

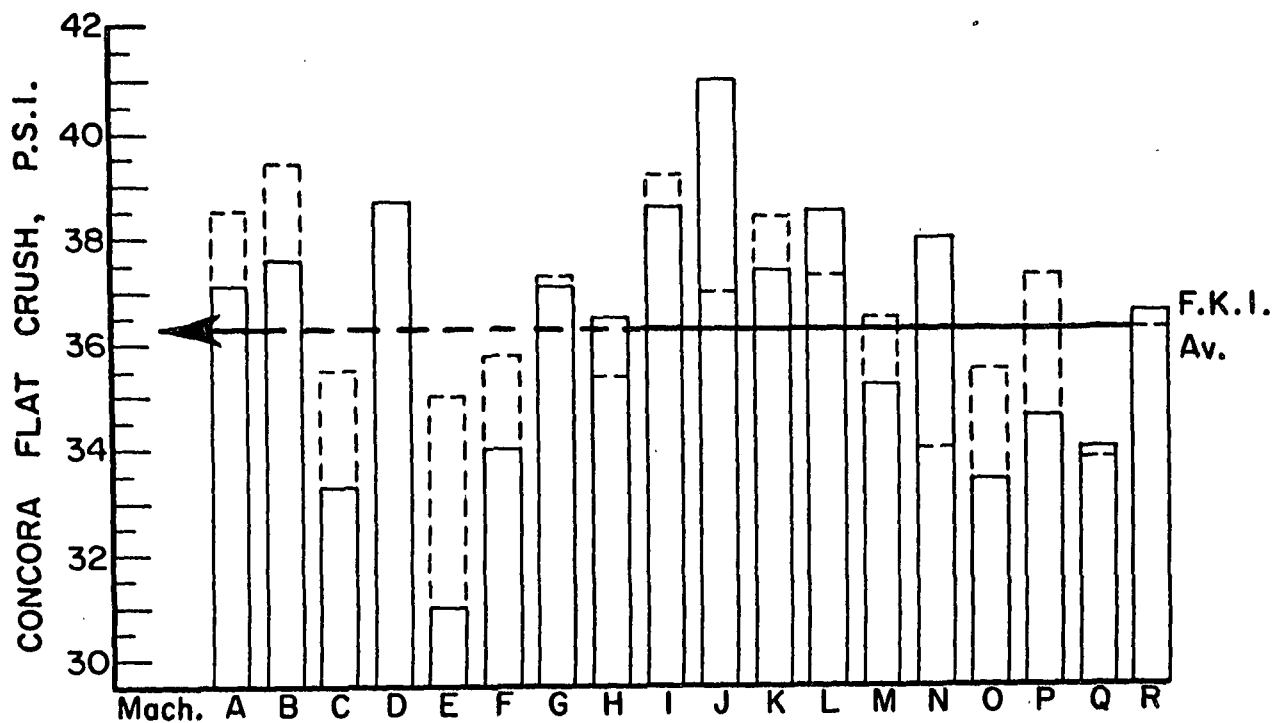


Figure 3. Comparison of Concora Flat Crush Results for October, 1960

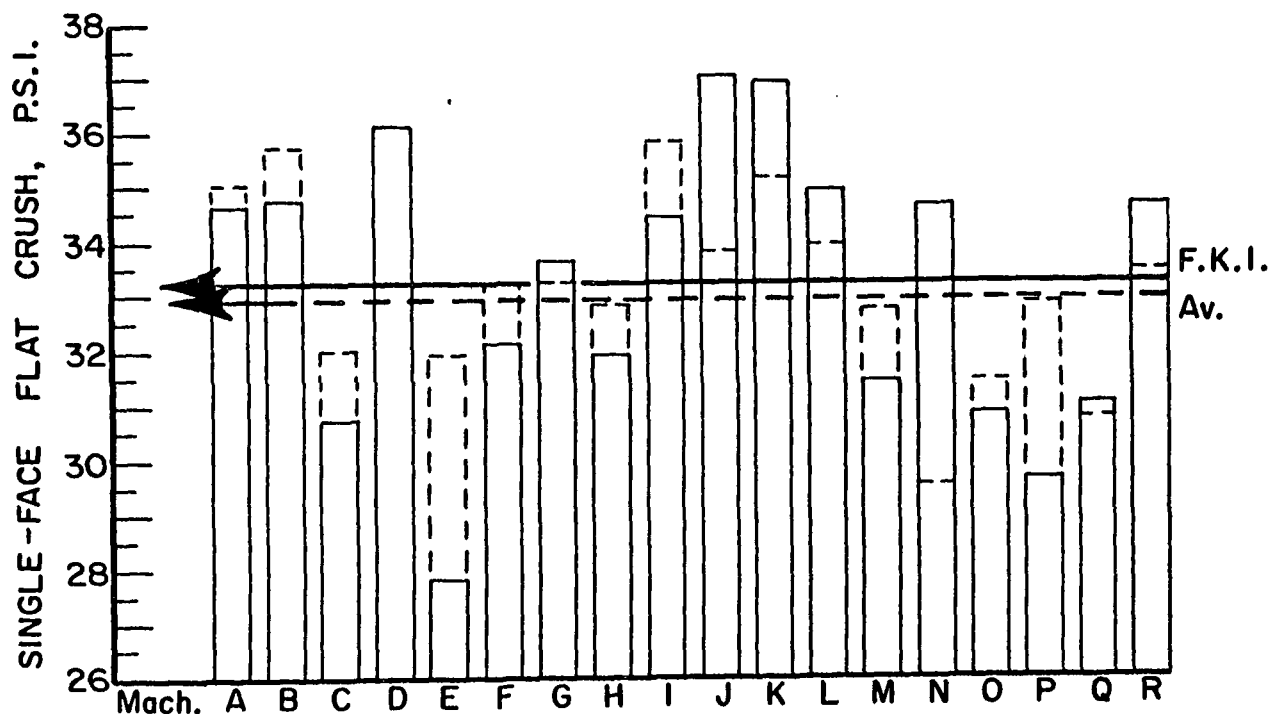


Figure 4. Comparison of Single-Face Flat Crush Results for October, 1960

———— Current machine average
----- Cumulative machine average

below 100% indicates that current quality is lower than the average result for the previous twelve periods.

In Table II the current machine averages for the month of October are summarized. It may be noted in Table II and Figure 1 that basis weight varied from a low of 25.9 lb. for Machine D to a high of 28.9 lb. for Machine J. The current F.K.I. average for basis weight was 27.3 lb., which was slightly lower than the cumulative F.K.I. average of 27.4 lb. Of the current machine averages shown in Table II, only the average for Machine D was below the 26-lb. minimum requirement of Rule 41. On the basis of individual rolls, it may be noted that the tabulated data for each machine shown in Tables III through XX included two basis weight averages which were below 26 lb.

With regard to the caliper results for the current period, it may be seen in Table II and also in Figure 2 that the lowest current machine average of 9.0 points was associated with Machine N, and the highest average of 11.8 points was associated with Machine H. The current F.K.I. average of 10.4 points was slightly higher than the cumulative F.K.I. average of 10.3 points. The minimum caliper requirement of nine points specified in Rule 41 was met by all participants on the basis of the current machine averages shown in Table II. On the basis of individual rolls, there were three caliper averages below 9 points.

The Concora flat crush averages are presented graphically in Figure 3 based on the data in Table II. An inspection of these results reveals that 41.0 p.s.i. was the highest average and 31.0 p.s.i. the lowest. Machine J had the highest average, whereas Machine E had the lowest average. The

current F.K.I. average of 36.3 p.s.i. was the same as the cumulative F.K.I. average.

The highest single-face flat crush average of 37.0 p.s.i. was obtained on the medium from Machine J and the lowest of 27.8 p.s.i. on the medium from Machine E. These data are shown in Table II and are presented graphically in Figure 4. The current F.K.I. average was 33.2 p.s.i., whereas the cumulative F.K.I. average was 32.9 p.s.i.

The runability data for the 87 rolls of medium evaluated during October are summarized as follows:

Runability	Number of Rolls	Percentage of Total Rolls
Less than 600 f.p.m. with minimum tension	0	0.0
600 f.p.m. with minimum tension	7	8.0
600 f.p.m. with tension of 1/2 lb. per in.	14	16.1
600 f.p.m. with tension of 1 lb. per in.	22	25.3
600 f.p.m. with tension of 1-1/2 lb. per in.	44	50.6

For the current period, the current F.K.I. averages for caliper and single-face flat crush were slightly higher than their respective cumulative F.K.I. averages whereas the current F.K.I. average for basis weight was slightly lower than its cumulative F.K.I. average and the current F.K.I. average for Concora flat crush was the same as its cumulative F.K.I. average.

The test results obtained on the sample lots submitted from the production of each of the machines are shown in Tables III through XX for Machines A through R, respectively. The maximum, minimum, and average test

results obtained on each sample lot are shown for all tests except basis weight for which only the average is shown; in addition, the over-all average result for all sample lots submitted from a given machine is shown for each test. The latter over-all averages are reported as "current machine averages." A cumulative machine average is also shown and is calculated by averaging the current machine averages for the previous twelve periods (excluding the current period). Also shown for each machine in Tables III to XX are the machine factor and machine index which are defined as follows:

$$\frac{\text{current machine average}}{\text{cumulative machine average}} \times 100 = \text{machine factor (\%)}$$

$$\frac{\text{current machine average}}{\text{cumulative F.K.I. average}} \times 100 = \text{machine index (\%)}$$

The machine factor and machine index provide a means for comparing the current machine average with either the previous results for that particular machine or with the cumulative results for all machines--i.e., the cumulative F.K.I. average.

TABLE III
SUMMARY OF TEST RESULTS FOR MACHINE A
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
A-1	9-19-60	10-1-60	--	27.9	10.5 10.2	39.0 34.2	36.4 34.6	1 1/2
A-2	9-20-60	10-1-60	--	28.1	10.5 10.1	40.2 36.6	38.4 36.6	1 1/2
A-3	9-28-60	10-14-60	--	27.8	10.3 10.0	39.0 33.0	34.2 33.2	1 1/2
A-4	10-7-60	10-14-60	--	28.0	10.8 10.0	37.2 34.2	32.6 31.0	1 1/2
A-5	10-12-60	10-25-60	--	27.3	10.3 10.0	39.0 35.4	34.6 32.4	1-1/2
A-6	10-22-60	10-25-60	--	26.6	10.1 9.0	41.4 35.4	36.4 34.6	1-1/2
Current Machine Average				27.6	10.2	37.1	34.6	
Cumulative Machine Average				27.5	10.3	38.5	35.0	
Machine Factor, %				100.5	99.1	96.4	98.9	
Machine Index, %				100.8	99.8	102.2	105.3	

TABLE IV
SUMMARY OF TEST RESULTS FOR MACHINE B
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
B-1	9-13-60	10-10-60	421	26.7	10.7 9.8	38.4 33.0	34.4 32.0	1-1/2
B-2	9-22-60	10-28-60	423	27.4	11.1 10.3	40.8 37.8	37.4 35.4	1-1/2
Current Machine Average				27.0	10.5	37.6	34.7	
Cumulative Machine Average				27.6	10.3	39.4	35.7	
Machine Factor, %				97.7	101.5	95.4	97.4	
Machine Index, %				98.6	102.3	103.5	105.6	

TABLE V
SUMMARY OF TEST RESULTS FOR MACHINE C
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points		Concora Flat Crush, p.s.i.		Single-Face Flat Crush, p.s.i.		Runability, Maximum Tension at 600 f.p.m., lb./in.	
					Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
C-1	10-10-60	10-17-60	389	27.5	9.9	9.2	37.2	29.4	31.2	26.0	29.3	1-1/2
C-2	10-10-60	10-17-60	390	27.2	9.9	9.1	34.8	28.2	31.6	29.2	30.0	1-1/2
C-3	10-14-60	10-18-60	397	27.4	9.2	8.0	35.4	31.8	35.6	31.4	33.0	1-1/2
C-4	10-14-60	10-18-60	398	27.4	9.2	8.3	36.0	31.2	32.0	28.8	30.4	1-1/2
Current Machine Average												
				27.4	9.2		33.3	30.7				
Cumulative Machine Average				27.3	9.5		35.5	32.0				
Machine Factor, %				100.3	96.6		93.9	95.9				
Machine Index, %				100.0	89.6		91.7	93.2				

TABLE VI
SUMMARY OF TEST RESULTS FOR MACHINE D
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points		Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.			
D-1	10-9-60	10-21-61	--	25.7	9.8	9.1	39.0	37.6	1-1/2
D-2	10-11-60	10-21-61	--	26.1	10.0	9.6	41.4	37.4	1/2
Current Machine Average									
				25.9	9.6		38.7	36.1	
Cumulative Machine Average				--	--		--	--	
Machine Factor, %				--	--		--	--	
Machine Index, %				94.6	94.0		106.5	109.6	

TABLE VII
SUMMARY OF TEST RESULTS FOR MACHINE E
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points		Concora Flat Crush, p.s.i.		Single-Face Flat Crush, p.s.i.		Runability, Maximum Tension at 600 f.p.m., lb./in.	
					Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
E-1	9-23-60	10-11-60	I-1	26.5	10.9	10.2	31.8	28.8	28.0	27.0	27.4	1-1/2
E-2	9-23-60	10-11-60	I-2	26.1	10.9	9.9	36.0	28.2	30.0	27.6	28.8	1-1/2
E-3	9-23-60	10-11-60	I-11	26.5	10.9	9.9	31.2	28.2	28.0	26.6	27.1	1-1/2
E-4	9-23-60	10-11-60	I-12	26.2	11.0	10.0	32.4	28.8	29.6	26.6	28.0	1-1/2
Current Machine Average												
				26.3			10.5		31.0		27.8	
Cumulative Machine Average				27.0			10.0		35.0		31.9	
Machine Factor, %				97.7			105.2		88.7		87.2	
Machine Index, %				96.2			102.6		85.4		84.6	

TABLE VIII
SUMMARY OF TEST RESULTS FOR MACHINE F
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points		Concora Flat Crush, p.s.i.		Single-Face Flat Crush, p.s.i.		Runability, Maximum Tension at 600 f.p.m., lb./in.	
					Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
F-1	8-15-60	9-15-60	2680	26.4	10.0	9.8	39.0	34.2	36.1	35.2	34.3	1-1/2
F-2	9- 1-60	10-27-60	134	27.1	10.8	10.3	34.2	32.4	33.2	31.0	32.2	1-1/2
F-3	9- 7-60	10-27-60	864	26.2	10.7	10.0	36.0	30.6	33.0	32.4	32.2	1
F-4	9-11-60	10-27-60	1503	26.1	11.0	10.4	34.2	32.4	33.2	31.0	30.7	1
F-5	9-27-60	10-27-60	4452	26.1	10.0	9.5	35.4	33.6	34.2	30.2	31.1	1
Current Machine Average												
				26.4			10.3		34.0		32.1	
Cumulative Machine Average				27.0			10.7		35.8		33.2	
Machine Factor, %				97.5			96.3		94.8		96.6	
Machine Index, %				96.3			100.4		93.5		97.6	

TABLE IX
SUMMARY OF TEST RESULTS FOR MACHINE G
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points		Concora Flat Crush, p.s.i.		Single-Face Flat Crush, p.s.i.		Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.	Max.	Min.	Max.	Min.	
G-1	9-21-60	9-27-60	393	27.9	9.9	9.5	42.0	38.4	39.0	36.4	1
G-2	9-24-60	10- 3-60	394	26.5	9.4	8.9	40.2	37.2	37.6	35.8	1/2
G-3	10-12-60	10-18-60	395	28.3	10.1	9.2	40.8	34.8	35.4	29.0	1-1/2
G-4	10-14-60	10-24-60	396	27.8	10.0	9.5	39.0	34.8	35.4	31.8	1
G-5	10-14-60	10-24-60	397	27.6	10.6	9.8	36.0	32.4	32.4	29.8	1
G-6	10-16-60	10-24-60	398	27.6	9.8	9.3	41.4	37.2	37.2	34.8	1-1/2
G-7	10-17-60	10-24-60	399	27.4	9.9	9.3	37.2	33.6	32.2	28.0	1
G-8	10-19-60	10-24-60	400	28.0	10.7	9.9	36.6	35.4	32.0	30.4	1-1/2
Current Machine Average											
				27.6							33.6
Cumulative Machine Average				27.2							33.2
Machine Factor, %				101.5							101.2
Machine Index, %				100.9							102.1

TABLE X
SUMMARY OF TEST RESULTS FOR MACHINE H
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points		Concora Flat Crush, p.s.i.		Single-Face Flat Crush, p.s.i.		Runability, Minimum Tension at 600 f.p.m., lb./in.
					Max.	Min.	Max.	Min.	Max.	Min.	
H-1	9-23-60	9-29-60	387	26.7	12.0	10.7	36.6	32.4	33.6	30.4	1
H-2	9-23-60	9-29-60	388	27.4	12.2	10.8	38.4	34.8	35.2	31.6	1-1/2
H-3	10- 4-60	10-11-60	395	27.6	13.6	12.0	39.0	36.0	35.0	32.2	1-1/2
H-4	10- 4-60	10-11-60	396	26.1	12.4	9.8	38.4	33.6	32.4	30.2	1-1/2
H-5	10-18-60	10-21-60	403	28.4	12.3	11.3	38.4	35.4	31.4	30.4	1-1/2
H-6	10-18-60	10-21-60	404	28.1	12.0	11.7	39.6	34.8	31.6	29.6	1-1/2
Current Machine Average											
				27.4							31.9
Cumulative Machine Average				27.0							33.1
Machine Factor, %				101.4							33.1
Machine Index, %				100.1							31.6
											31.0
											31.0
											31.9
											32.8
											97.3
											97.1

TABLE XI
SUMMARY OF TEST RESULTS FOR MACHINE I
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
I-1	9-28-60	10-3-60	587	26.7	10.8 10.1 10.4	40.8 36.6 38.0	37.0 35.0 36.4	1-1/2
I-2	10-1-60	10-11-60	588	26.8	11.0 10.6 10.8	43.2 36.6 38.5	35.2 32.6 34.2	1-1/2
I-3	10-4-60	10-10-60	589	27.1	11.5 10.2 10.8	42.0 37.8 40.4	36.8 33.6 35.4	1-1/2
I-4	10-11-60	10-14-60	590	26.5	11.3 10.7 10.9	40.2 35.4 38.2	34.8 32.0 33.5	1
I-5	10-14-60	10-18-60	591	26.5	11.0 10.3 10.8	40.8 36.6 37.9	34.2 31.6 32.5	1-1/2
Current Machine Average								
					10.7	38.6	34.4	
Cumulative Machine Average					10.7	39.2	35.8	
Machine Factor, %					100.0	98.6	96.2	
Machine Index, %					104.7	106.3	104.6	

TABLE XII
SUMMARY OF TEST RESULTS FOR MACHINE J
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
J-1	9-21-60	10-14-60	285	29.5	12.0 11.0 11.6	42.6 39.6 41.2	37.2 36.6 37.0	1
J-2	9-27-60	10-14-60	286	30.6	11.8 11.3 11.6	43.8 40.8 42.7	40.2 39.0 39.6	1/2
J-3	10-4-60	10-24-60	287	28.1	11.5 10.7 11.1	41.4 39.0 40.3	36.6 34.8 35.4	1-1/2
J-4	10-10-60	10-24-60	288	27.8	11.5 10.9 11.1	40.8 37.8 39.6	37.0 35.0 35.9	1-1/2
J-5	10-19-60	10-24-60	289	28.3	10.9 10.0 10.4	43.8 38.4 41.2	37.8 36.0 37.0	1-1/2
Current Machine Average								
					11.2	41.0	37.0	
Cumulative Machine Average					10.5	37.0	33.8	
Machine Factor, %					106.6	110.8	109.3	
Machine Index, %					108.9	112.8	112.4	

TABLE XIII
SUMMARY OF TEST RESULTS FOR MACHINE K
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points		Concora Flat Crush, p.s.i.		Single-Face Flat Crush, p.s.i.		Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.	Max.	Min.	Max.	Min.	
K-1	9-7-60	10-10-60	136	27.6	11.2	10.0	39.0	34.2	38.8	36.8	1
K-2	9-8-60	10-10-60	170	27.1	11.0	10.2	38.4	36.0	38.6	35.6	Min.
K-3	9-14-60	10-10-60	374	26.9	9.8	9.1	42.0	37.2	39.4	36.4	1-1/2
K-4	9-20-60	10-10-60	574	27.1	11.2	9.9	39.0	36.0	37.4	36.2	1
K-5	9-23-60	10-10-60	676	27.3	10.3	9.9	37.8	34.8	37.4	33.6	1
Current Machine Average				27.2	10.3		37.4		36.9		
Cumulative Machine Average				26.7	10.4		38.4		35.1		
Machine Factor, %				102.0	99.2		97.3		105.2		
Machine Index, %				99.3	100.1		103.0		112.1		

TABLE XIV
SUMMARY OF TEST RESULTS FOR MACHINE L
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runability, Maximum Tension at 600 f.p.m., lb./in.		
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
L-1	9-19-60	9-30-60	--	27.4	10.7	9.9	10.3	39.0	34.8	37.6	35.8	34.6	35.3	1/2		
L-2	9-24-60	9-30-60	--	27.8	10.7	10.0	10.3	40.8	38.4	40.2	39.8	37.2	38.4	Min.		
L-3	9-27-60	10-14-60	--	26.5	10.2	9.8	10.0	42.0	39.6	40.7	37.0	34.0	35.3	1/2		
L-4	9-28-60	10-14-60	--	27.1	10.9	10.0	10.4	41.4	38.4	39.4	36.4	34.2	35.2	1/2		
L-5	9-30-60	10-14-60	--	27.6	10.8	10.0	10.4	42.6	37.8	39.5	35.8	34.4	35.0	1/2		
L-6	10- 4-60	10-14-60	--	27.5	10.9	10.3	10.6	38.4	37.2	37.9	34.2	32.6	33.3	Min.		
L-7	10- 7-60	10-14-60	--	27.3	11.0	10.2	10.6	38.4	34.8	36.1	34.0	31.4	32.5	1-1/2		
L-8	10-22-60	10-25-60	--	26.5	10.5	9.8	10.1	37.2	36.6	36.8	35.0	33.0	34.0	1-1/2		
Current Machine Average				27.2			10.3			38.5			34.9			
Cumulative Machine Average				27.0			10.1			37.3			33.9			
Machine Factor, %				100.7			102.6			103.4			102.8			
Machine Index, %				99.3			100.7			106.0			106.0			

TABLE XV
SUMMARY OF TEST RESULTS FOR MACHINE M
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points		Concora Flat Crush, p.s.i.		Single-Face Flat Crush, p.s.i.		Runability, Maximum Tension at 600 f.p.m., lb./in.	
					Max.	Min.	Max.	Min.	Max.	Min.	Av.	Av.
M-1	9-30-60	10-4-60	391	27.4	11.2	10.8	11.0	36.0	32.4	34.7	35.0	33.2
M-2	9-30-60	10-4-60	392	27.3	11.2	10.9	11.1	35.4	34.2	34.7	33.2	31.3
M-3	10-14-60	10-17-60	399	28.5	11.2	10.8	11.0	37.8	34.2	36.1	32.4	31.5
M-4	10-14-60	10-17-60	400	27.6	11.0	10.8	10.9	37.8	33.0	35.5	30.8	29.7
Current Machine Average												
				27.7			11.0			35.2		
				27.7			10.9			36.5		
				100.0			100.7			96.5		
				101.0			107.4			97.0		

TABLE XVI
SUMMARY OF TEST RESULTS FOR MACHINE N
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points		Concora Flat Crush, p.s.i.		Single-Face Flat Crush, p.s.i.		Runability, Maximum Tension at 600 f.p.m., lb./in.	
					Max.	Min.	Max.	Min.	Max.	Min.	Av.	Av.
N-1	10-4-60	10-14-60	41	28.3	9.8	8.5	9.0	40.2	37.2	38.5	35.6	34.7
N-2	10-4-60	10-14-60	42	28.3	9.3	8.5	8.9	39.0	36.6	37.7	34.4	33.8
N-3	10-4-60	10-14-60	43	28.7	9.2	8.9	9.0	39.0	36.6	37.7	36.0	35.0
N-4	10-4-60	10-14-60	44	28.2	9.0	9.0	9.0	40.8	35.4	37.9	35.4	34.9
Current Machine Average												
				28.4			9.0			38.0		
				27.5			9.3			34.0		
				103.4			97.1			111.5		
				103.6			87.7			104.4		

TABLE XVII
SUMMARY OF TEST RESULTS FOR MACHINE O
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points		Concora Flat Crush, p.s.i.		Single-Face Flat Crush, p.s.i.		Runability, Maximum Tension at 600 f.p.m., lb./in.	
					Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
0-1	9-12-60	10-5-60	68	25.7	11.3	10.4	26.4	23.4	26.4	23.0	24.4	1-1/2
0-2	9-16-60	10-5-60	69	27.6	12.7	10.2	39.0	31.2	32.4	28.0	30.4	1-1/2
0-3	9-21-60	10-14-60	70	28.2	11.3	10.6	39.6	35.4	32.2	30.8	31.6	Min.
0-4	9-27-60	10-14-60	71	26.0	11.1	9.5	37.8	33.0	35.4	32.8	33.8	1/2
0-5	9-29-60	10-27-60	72	27.7	11.2	10.1	37.2	30.6	33.6	30.6	31.7	1
0-6	10-12-60	10-27-60	73	28.4	12.7	11.5	34.2	30.0	34.6	31.6	32.7	1/2
Current Machine Average				27.3							30.8	
Cumulative Machine Average				27.0							31.4	
Machine Factor, %				100.8							97.9	
Machine Index, %				99.5							93.5	

SUMMARY OF TEST RESULTS FOR MACHINE P October, 1960

TABLE XIX

SUMMARY OF TEST RESULTS FOR MACHINE Q

	Q-1	9-21-60	9-29-60	385	26.6	10.9	10.1	10.6	33.0	28.8	31.4	31.6	28.8	30.1	1/2
	Q-2	9-21-60	9-29-60	386	26.3	10.8	10.2	10.6	34.2	31.2	33.1	33.2	30.6	31.7	1
	Q-3	10-4-60	10-14-60	393	27.4	11.0	10.6	10.8	36.0	33.0	34.9	30.0	29.0	29.4	Min.
	Q-4	10-4-60	10-14-60	394	27.4	10.9	10.2	10.7	36.0	32.4	34.0	31.4	29.2	30.5	1/2
	Q-5	10-21-60	10-28-60	401	27.4	10.8	9.9	10.5	39.0	31.8	35.5	33.8	32.0	32.7	1-1/2
	Q-6	10-21-60	10-28-60	402	27.3	10.4	9.6	10.0	36.0	33.0	34.8	33.2	30.8	31.6	1-1/2
	Current Machine Average				27.0			10.5			34.0			31.0	
	Cumulative Machine Average				27.3			10.7			33.8			30.7	
	Machine Factor, %				99.2			98.9			100.6			101.0	
	Machine Index, %				98.8			102.8			93.5			94.3	

TABLE XX
SUMMARY OF TEST RESULTS FOR MACHINE R
October, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
R-1	9-23-60	10-1-60	--	26.4	10.0 9.5	39.6 36.6	38.0 35.4	1 36.7
R-2	9-26-60	10-1-60	--	27.1	10.6 9.9	39.6 36.0	37.4 36.0	1 36.5
R-3	9-30-60	10-14-60	--	26.8	10.2 9.9	37.8 35.4	36.6 34.8	1 35.7
R-4	10-22-60	10-25-60	--	27.4	10.5 9.8	38.4 34.8	36.7 32.8	1 33.0
R-5	10-24-60	10-27-60	--	26.5	10.9 10.0	35.4 32.4	33.8 30.2	1 31.3
Current Machine Average				26.8			36.6	34.6
Cumulative Machine Average				26.8			36.3	33.4
Machine Factor, %				100.0			100.7	103.5
Machine Index, %				98.0			100.7	105.2

DISCUSSION OF CONCORA FLAT CRUSH TEST RESULTS OBTAINED AT THE
INSTITUTE OF PAPER CHEMISTRY AND THOSE OBTAINED AT THE MILLS

In Table XXI a comparison of Institute and Mill Concora flat crush test results obtained on conditioned specimens is given for the month of October. These comparisons were initiated in Progress Report 30 and permit interested participants to submit their Concora flat crush test results to The Institute of Paper Chemistry so that comparative results may be included in the monthly reports. Data sheets for supplying this information may be obtained from the Institute. Comparisons of this kind are a helpful adjunct to other calibration procedures. It may be noted in Table XXI that fourteen of the eighteen participating machines are included in this comparison of Concora flat crush data. Shown in Table XXI are the Institute and mill Concora averages for each roll included in this comparison, the difference between the roll average based on Institute data and that based on mill data, the Institute and mill averages based on all rolls included in the comparison, and the difference between these over-all averages.

The Concora flat crush data shown in Table XXI are summarized in Part I of Table XXII where for each machine the following information is given: (1) Current machine average based on Institute data, (2) current machine average based on mill data, (3) the average difference--that is, the difference between the current machine average based on Institute data and that based on mill data and (4) the maximum difference encountered in comparing Institute and mill test averages for individual rolls. In Part II of Table XXII the average difference of Part I has been converted to per cent by dividing it by the Institute

TABLE XXI
INSTITUTE AND MILL CONCORRA FLAT CRUSH TEST RESULTS ON INDIVIDUAL ROLLS FOR OCTOBER, 1960

Machine A					Machine B					Machine C				
Code	Roll No.	Date Made	Concorra Insti- tute	Flat Crush, p.s.i. Differ- ence a	Code	Roll No.	Date Made	Concorra Insti- tute	Flat Crush, p.s.i. Differ- ence a	Code	Roll No.	Date Made	Concorra Insti- tute	Flat Crush, p.s.i. Differ- ence a
A-1	--	9-19-60	36.6	0.0	B-1	421	9-13-60	36.0	38.2	C-1	389	10-10-60	33.6	35.9
A-2	--	9-20-60	38.3	0.0	B-2	423	9-22-60	39.2	39.0	C-2	390	10-10-60	32.4	35.9
A-3	--	9-28-60	36.7	-0.6						C-3	397	10-14-60	34.1	36.3
										C-4	398	10-14-60	33.2	36.6
Current Machine Av.			37.2	-0.2	Current Machine Av.			37.6	38.6	Current Machine Av.			33.3	36.2
									+1.0					+2.9
Machine F					Machine G					Machine H				
Code	Roll No.	Date Made	Concorra Insti- tute	Flat Crush, p.s.i. Differ- ence a	Code	Roll No.	Date Made	Concorra Insti- tute	Flat Crush, p.s.i. Differ- ence a	Code	Roll No.	Date Made	Concorra Insti- tute	Flat Crush, p.s.i. Differ- ence a
F-1	2680	8-15-60	36.1	-0.2	G-1	393	9-21-60	39.8	42.4	H-1	387	9-23-60	34.9	35.8
F-2	134	9-1-60	33.2	+0.4	G-2	394	9-24-60	38.9	42.6	H-2	388	9-23-60	36.0	36.5
F-3	864	9-7-60	33.0	+0.7	G-3	395	10-12-60	36.5	37.4	H-3	395	10-4-60	37.3	37.4
F-4	1503	9-11-60	33.2	+0.7	G-4	396	10-14-60	36.4	40.2	H-4	396	10-4-60	36.2	34.7
F-5	4452	9-27-60	34.2	-0.8	G-5	397	10-14-60	34.3	37.4	H-5	403	10-18-60	37.0	44.0
					G-6	398	10-16-60	39.5	42.1	H-6	404	10-18-60	37.8	37.4
					G-7	399	10-17-60	35.4	35.5					+7.0
					G-8	400	10-19-60	36.2	35.4					-0.4
Current Machine Av.			34.0	+0.1	Current Machine Av.			37.1	39.1	Current Machine Av.			36.5	37.6
									+2.0					+1.1
Machine I					Machine J					Machine K				
Code	Roll No.	Date Made	Concorra Insti- tute	Flat Crush, p.s.i. Differ- ence a	Code	Roll No.	Date Made	Concorra Insti- tute	Flat Crush, p.s.i. Differ- ence a	Code	Roll No.	Date Made	Concorra Insti- tute	Flat Crush, p.s.i. Differ- ence a
I-1	587	9-28-60	38.0	+1.6	J-1	285	9-21-60	41.2	41.8	K-1	136	9-7-60	37.2	39.1
I-2	588	10-1-60	38.5	+1.6	J-2	286	9-27-60	42.7	42.7	K-2	170	9-8-60	37.2	36.0
I-3	589	10-4-60	40.4	-1.2						K-3	374	9-14-60	38.8	39.5
I-4	590	10-11-60	38.2	+0.6						K-4	574	9-20-60	37.4	37.6
I-5	591	10-14-60	37.9	-0.1						K-5	676	9-23-60	36.5	36.6
Current Machine Av.			38.6	+0.5	Current Machine Av.			42.0	42.2	Current Machine Av.			37.4	37.8
									+0.2					+0.4

a This difference is the amount in p.s.i. units by which the mill result is higher or lower than the Institute result.

TABLE XXI--CONTINUED
INSTITUTE AND MILL CONCORRA FLAT CRUSH TEST RESULTS ON INDIVIDUAL ROLLS FOR OCTOBER, 1960

Machine L					Machine M					Machine N										
Mill	Roll	Date	Concorra Flat Crush, p.s.i.	Differ-	Mill	Roll	Date	Concorra Flat Crush, p.s.i.	Differ-	Mill	Roll	Date	Concorra Flat Crush, p.s.i.	Differ-						
Code	No.	Made	Insti- tute	ence a	Code	No.	Made	Insti- tute	ence a	Code	No.	Made	Insti- tute	ence a						
L-1	--	9-19-60	37.6	+0.9	M-1	391	9-30-60	34.7	+1.1	N-1	41	10-4-60	38.5	-0.9						
L-2	--	9-24-60	40.2	0.0	M-2	392	9-30-60	34.7	-0.1	N-2	42	10-4-60	37.7	+2.6						
L-3	--	9-27-60	40.7	0.0	M-3	399	10-14-60	36.1	+2.1	N-3	43	10-4-60	37.7	+2.0						
L-4	--	9-28-60	39.4	-1.0	M-4	400	10-14-60	35.5	+3.6	N-4	44	10-4-60	37.9	+1.2						
L-5	--	9-30-60	39.5	+0.8																
Current Machine Av.					39.5	+0.1	Current Machine Av.					35.2	+1.7	Current Machine Av.					38.0	+1.2
Machine Q					Machine R															
Mill	Roll	Date	Concorra Flat Crush, p.s.i.	Differ-	Mill	Roll	Date	Concorra Flat Crush, p.s.i.	Differ-	Mill	Roll	Date	Concorra Flat Crush, p.s.i.	Differ-						
Code	No.	Made	Insti- tute	ence a	Code	No.	Made	Insti- tute	ence a	Code	No.	Made	Insti- tute	ence a						
Q-1	385	9-21-60	31.4	-2.5	R-1	--	9-23-60	38.2	0.0											
Q-2	386	9-21-60	33.1	+1.3	R-2	--	9-26-60	37.4	0.0											
Q-3	393	10-4-60	34.9	-2.9	R-3	--	9-30-60	36.8	-0.3											
Q-4	394	10-4-60	34.0	-1.8																
Q-5	401	10-21-60	35.5	-3.3																
Q-6	402	10-21-60	34.8	-2.9																
Current Machine Av.					34.0	-2.1	Current Machine Av.					37.5	-0.1	Current Machine Av.					37.4	-0.1

^a This difference is the amount in p.s.i. units by which the mill result is higher or lower than the Institute result.

TABLE XXII

PART I: A COMPARATIVE SUMMARY FOR EACH MACHINE OF THE CONCORRA FLAT CRUSH AVERAGES BASED ON INSTITUTE DATA AND THOSE BASED ON MILL DATA

Machine Code	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Number of Rolls Compared	3	2	4	0	0	5	8	6	5	2	5	5	4	4	0	0	6	3
Concorra Flat Crush, p.s.i.																		
Current Machine Av. (Institute) ^a	37.2	37.6	33.3	--	--	34.0	37.1	36.5	38.6	42.0	37.4	39.5	35.2	38.0	--	--	34.0	37.5
Current Machine Av. (Mill) ^a	37.0	38.6	36.2	--	--	34.1	39.1	37.6	39.1	42.2	37.8	39.6	36.9	39.2	--	--	31.9	37.4
Average Difference ^b	-0.2	+1.0	+2.9	--	--	+0.1	+2.0	+1.1	+0.5	+0.2	+0.4	+0.1	+1.7	+1.2	--	--	-2.1	-0.1
Maximum Difference ^c	-0.6	+2.2	+3.5	--	--	-0.8	+3.8	+7.0	+1.6	+0.6	+1.9	-1.0	+3.6	+2.6	--	--	-3.3	-0.3

PART II: A TABULATION FOR EACH MACHINE OF THE AVERAGE DIFFERENCE (PER CENT) BETWEEN THE CONCORRA FLAT CRUSH AVERAGE BASED ON INSTITUTE DATA AND THAT BASED ON MILL DATA

Average Difference, % ^d																		
Current Report (October)	-0.5	+2.7	+8.7	--	--	+0.3	+5.4	+3.0	+1.3	+0.5	+1.1	+0.3	+4.8	+3.2	--	--	-6.2	-0.3
75th Report (September)	-6.5	-1.5	+8.5	--	--	+0.3	+10.9	+6.4	+2.2	+8.5	-5.0	+0.5	+3.7	+0.9	--	--	+1.7	-5.3
73rd Report (August)	-4.2	+1.5	+8.3	--	--	+4.4	+5.1	+6.9	+4.3	+11.1	--	-2.6	+11.6	-5.0	--	--	+5.9	+0.3

^a Comparisons based on current machine average include only those rolls for which mill data were submitted.

^b Average difference is the difference between the current machine average based on Institute test results and that based on mill test results with the Institute test results used as the reference. See Table XXI.

^c Maximum difference is the greatest difference encountered in comparing Institute and mill test averages for individual rolls. See Table XXI.


^d Average difference (per cent) is computed by dividing the average difference in p.s.i. (shown above in Part I of this table) by the Institute current machine average and multiplying the result by 100.

average and multiplying the result by 100. The average differences in per cent for the current report and the two preceding reports are shown. It may be seen that, for the current period, the highest average difference of 8.7% was associated with Machine C and the lowest of 0.3% with Machines F, L, and R. In the majority of comparisons, agreement between Institute and mill data was good, as evidenced by the following comparison of Institute and mill Concora flat crush results which shows the number of machines (and the cumulative percentage of all machines which this number represents) whose average Concora flat crush test results for the month of October fall within designated percentage ranges from the corresponding data obtained at the Institute:


Average Percentage Difference Between Institute and Mill Concora Flat Crush Test Results ^a	Number of Machines	Percentage of All Machines
± 1.0	5	35.7
± 2.5	7	50.0
± 5.0	11	78.6
± 8.7	14	100.0

^a The average obtained at the Institute was used as the reference in the calculation of the percentage differences.

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